Morphometry and Catchment Areas for the Calibrated Watersheds

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Data Report DR 87/4

PREFACE

The Data Report Series is intended as a readily available source of basic data collected for lakes and watersheds in the Muskoka/-Haliburton area of Ontario. These data were collected as part of the Lakeshore Capacity Study and/or the Acid Precipitation in Ontario Study.

The limnological portion of the Lakeshore Capacity Study (1975-81) was initiated to investigate the relationships between lakeshore development and lake trophic status in low ionic strength Precambrian Shield lakes. The Acid Precipitation in Ontario Study (1979-present) was initiated, in part, to investigate the effects of the deposition of strong acids on aquatic and terrestrial ecosystems in Ontario. The primary findings of these studies have been and will continue to be published as reviewed papers and technical reports.

Reid, R.A., R. Girard and A.C. Nicolls. 1987. The Morphometry and Catchments areas for the Calibrated Watersheds. Ont. Min. Environ. Data Report DR 87/4.

Abstract

The revised catchment areas and lake morphometry of Blue Chalk, Chub, Crosson, Dickie, Harp, Heney, Plastic and Red Chalk Lakes are reported.

The areas of three of the sub-catchments - Harp Inflow #4, Plastic Inflow #1 and Paint Inflow #1 which are divided into micro-catchments are also included.

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INTRODUCTION

This report provides the revised catchment areas and lake morphometry of Blue Chalk, Chub, Crosson, Dickie, Harp, Heney, Plastic and Red Chalk Lakes and their catchments.

Three of the sub-catchments - Harp Inflow #4, Plastic Inflow #1 and Paint Inflow #1 are divided in "micro" catchments.

METHOD

i. Catchments

The field methodology described here is a summary of the methods used for ground surveys completed during 1984-86 by Geodet Consultants.

A local coordinate network was established in each watershed by physically locating permanent control points (8 inch spikes) along the boundary of the watershed (i.e. Red Chalk #1, Blue Chalk #1, Crosson ungauged). For example, the Red Chalk and Blue Chalk Lakes watershed had 430 uniquely numbered control points. Compass bearings taken along the survey control oriented the control system to true north. An arbitrary control point in the network was assigned a metric coordinate value (x,y). The magnitude of the assigned values assured that each control point had a positive value. True easting and northing values (Universal Transverse Mercator) will replace the assigned metric coordinate values by surveying from a known Geological Survey of Canada UTM point.

The lake level was surveyed with an Electronic Distance Measuring (EDM) device (Model - Top Con Guppy) to a control point which referenced the elevations of the control network to the lake. The lake level was set arbitrarily to 100.000 metres. All of the control points were surveyed with the EDM and mathematically adjusted to produce a local, 3-D, co-ordinated data base oriented to true north and related to the lake level. Some of the surveys in certain watersheds took 3-4 months to complete and during this length of time the level of the lake usually changes, but the value of the original reference elevation

remained the same. Therefore, the relative difference in elevation between any two points is correct for these two points in the watershed.

All the watershed elements were surveyed. This included surveying from the control point elements such as roads, watershed boundaries, streams, weirs and any other important topographical features using the co-ordinted control system. A computer model was used to generate a map and calculate the area of each catchment.

ii. Lakes

The morphometric maps for Blue Chalk, Crosson, Dickie, Heney and Red Chalk lakes are not altered from those published earlier (Girard et al. 1985 and Nicolls et al. 1983). The morphometric maps for Harp and Plastic have been re-drawn from morphometry data collected in 1987. The areas of the contours and lake volumes for these lakes are revised (Appendix 3).

INTRODUCTION

Le présent rapport est une mise à jour des bassins versants et des données morphométriques des lacs suivants : Blue Chalk, Chub, Crosson, Dickie, Harp, Heney, Plastic et Red Chalk.

On a subdivisé les bassins et trois de ces subdivisions - Harp n° 4, Plastic n° 1 et Paint n° 1 - ont été subdivisées en plus petits bassins.

MÉTHODE

i. Bassins versants

La méthodologie décrite dans le présent rapport est un résumé des méthodes d'analyse de terrain employées par la société Geodet Consultants entre 1984 et 1986.

On a créé un réseau de coordonnées locales pour chaque bassin versant, en plantant des repères (piquets de 8 pouces) le long des limites des bassins (c.-à-d. le réseau Red Chalk n° 1, le réseau Blue Chalk n° 1, le réseau Crosson, non mesuré). Les bassins versants des lacs Red Chalk et Blue Chalk ont chacun 430 repères numérotés. Pour orienter les repères vers le nord géographique, on a fait des relèvements au compas le long des réseaux. Puis, on a attribué des coordonnées cartésiennes (x, y) à un repère choisi au hasard. On s'assure que chaque repère possède une valeur positive grâce à l'importance des coordonnées attribuées. Mentionnons également que les coordonnées rectangulaires direction O-E et les coordonnées rectangulaires direction S-N (projection de Mercator transverse) remplaceront désormais les coordonnées cartésiennes; les relevés topographiques seront effectués à partir d'un point UTM connu, établi par la Commission géologique du Canada.

Un appareil de mesure électronique des distances (MÉD) (modèle Top Con Guppy) nous a permis de comparer, à partir d'un bassin donné, le niveau des bassins et le niveau réel du lac. On a arbitrairement fixé ce dernier à 100 000 mètres. On a mesuré ainsi tous les repères, qu'on a rajustés mathématiquement afin de créer une banque tridimensionnelle de coordonnées locales, orientées vers le nord géographique et reliées au niveau du lac. Dans certains cas, les analyses n'ont pu être terminées avant trois ou quatre mois, mais même si le niveau du lac avait fluctué entretemps, l'altitude originelle n'avait pas changé. Par conséquent, la différence d'altitude entre deux repères donnés est exacte pour ces deux repères du bassin versant.

On a analysé tous les éléments des bassins versants, en étudiant, à l'aide du système de coordonnées de contrôle, les chemins, les cours d'eau, les déversoirs, les limites des bassins ainsi que toute autre caractéristique topographique importante. Pour produire le plan et calculer la superficie de chaque bassin, on s'est servi d'un modèle informatique.

ii. Lacs

On n'a pas modifié les plans morphométriques des lacs Blue Chalk, Crosson, Dickie, Heney et Red Chalk par rapport à l'édition précédente (Girard et coll., 1985; et Nicolls et coll., 1983). Les plans morphométriques des lacs Harp et Plastic ont été refaits à partir de données recueillies en 1987, de sorte que les contours et le volume de ces lacs sont maintenant à jour (annexe 3).

References

Nicolls, A., R. Reid and B.Girard. 1983. Morphometry of the Muskoka-Haliburton study lakes. Ont. Min. Envir. Data Report DR 83/3.

Girard, R., R.A. Reid and W.R. Snyder. 1985. The morphometry and geology of Plastic and Heney lakes and their catchments. Ont. Min. Envir. Data Report DR 85/1.

Scheider, W.A., C.M. Cox and L.D. Scott. 1983. Hydrological data for lakes and watersheds in the Muskoka-Haliburton study area (1976-1980). Ont. Min. Envir. Data Report DR 83/6.

Appendix 1. Catchment Maps and Areas

Blue Chalk

Chub

Crosson

Dickie

Harp

Heney

Plastic

Red Chalk

FIGURE 1: BLUE CHALK LAKE

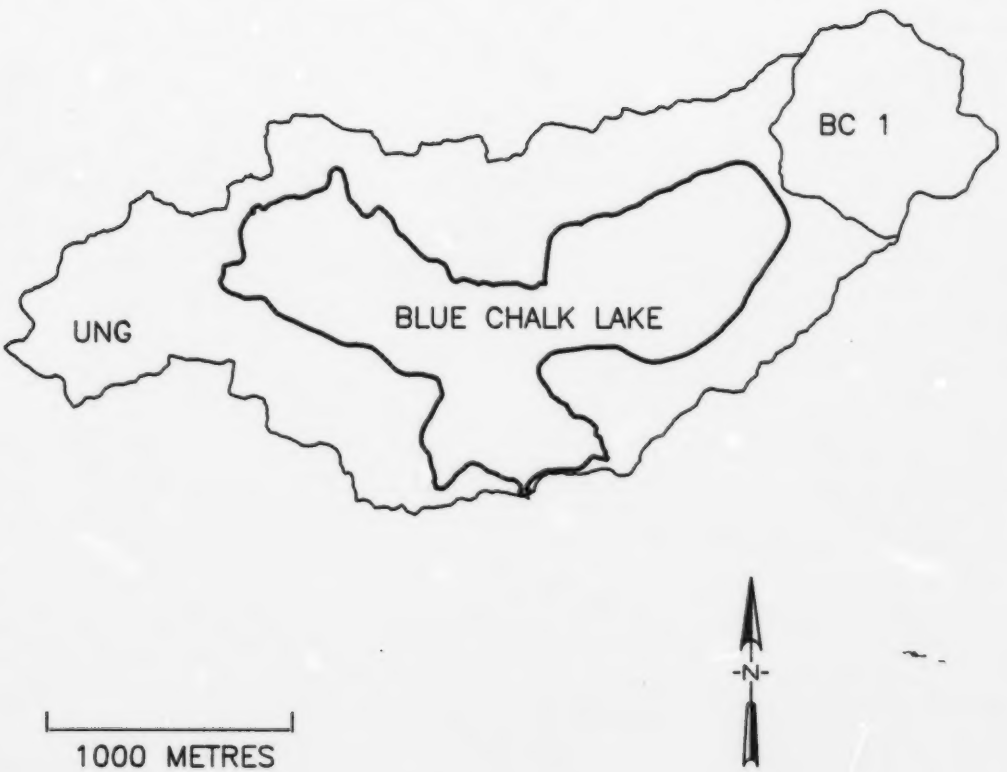


Table 1. Blue Chalk catchment

	Area (ha)
Inflows	
#1	20.43
Ungauged	85.50
TOTAL	105.93
Lake	52.35
Total Catchment	158.28

FIGURE 2: CHUB LAKE

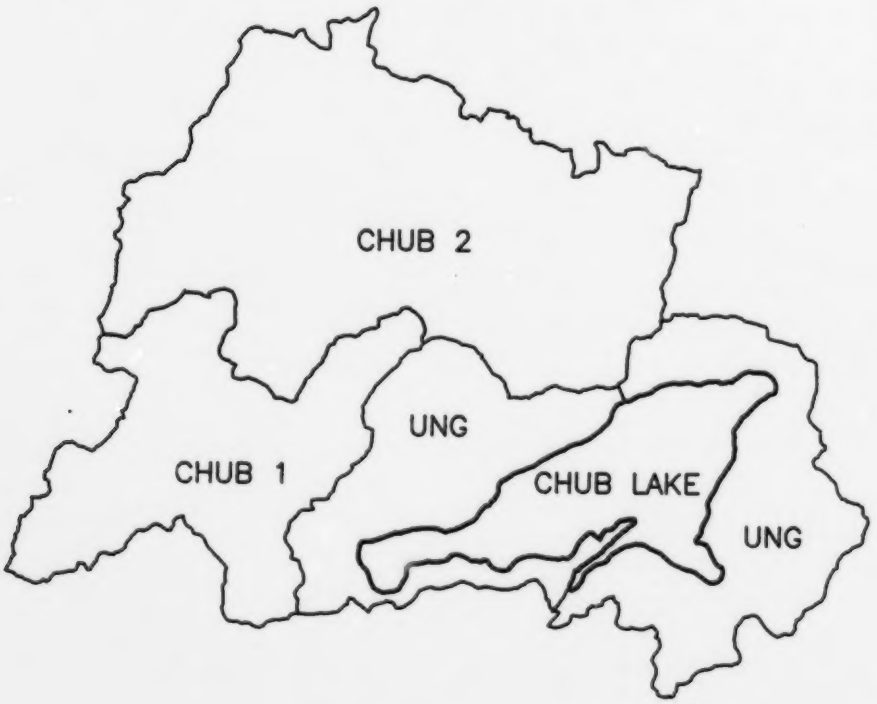


Table 2. Chub Lake catchment

	Area (ha)
Inflows	
#1	59.69
#2	126.0
Ungauged	86.15
TOTAL	271.84
Lake	34.31
Total Catchment	306.25

FIGURE 3: CROSSON LAKE

Table 3. Crosson Lake catchment

	Area (ha)
Inflows	
#1	456.27
Ungauged	65.48
TOTAL	521.75
Lake	56.74
Total Catchment	578.49

FIGURE 4: DICKIE LAKE

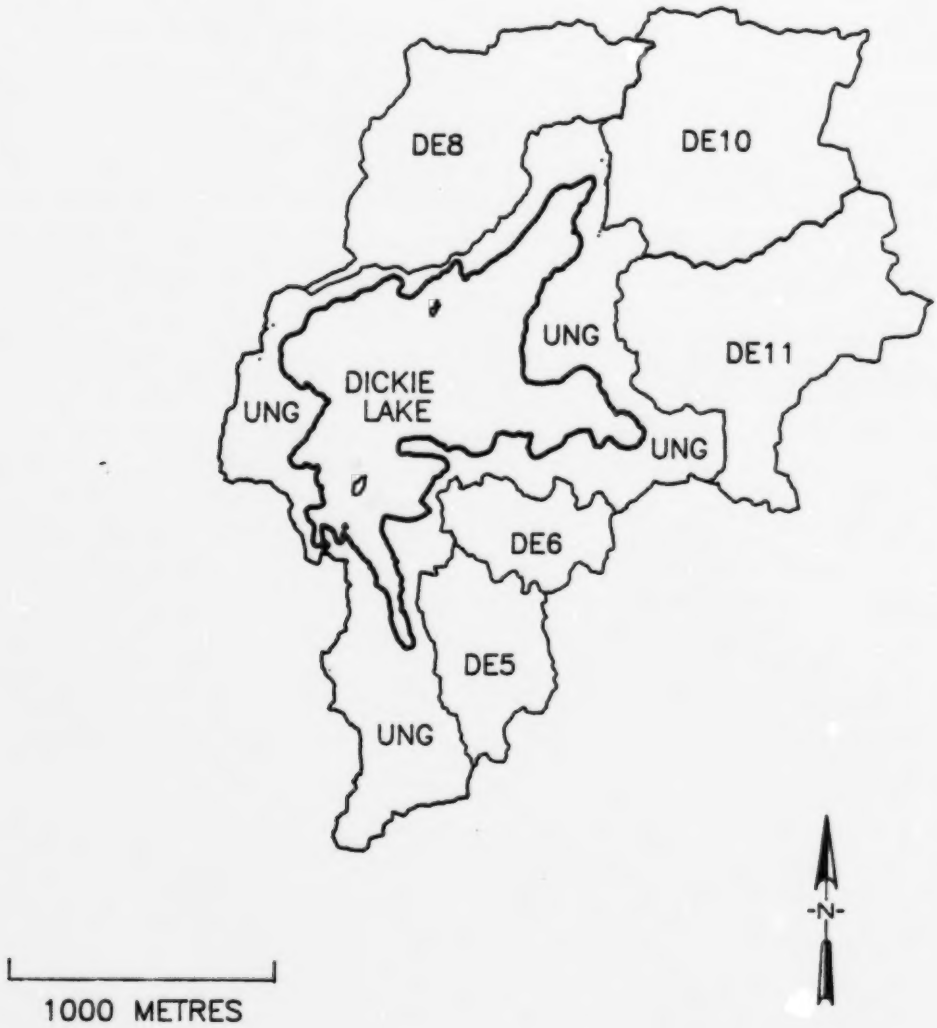


Table 4. Dickie Lake catchment

	Area (ha)
Inflows	
#5	29.98
#6	21.80
#8	66.96
#10	78.89
#11	76.27
Ungauged	132.52
TOTAL	406.42
Lake	93.60
Total Catchment	500.02

FIGURE 5: HARP LAKE

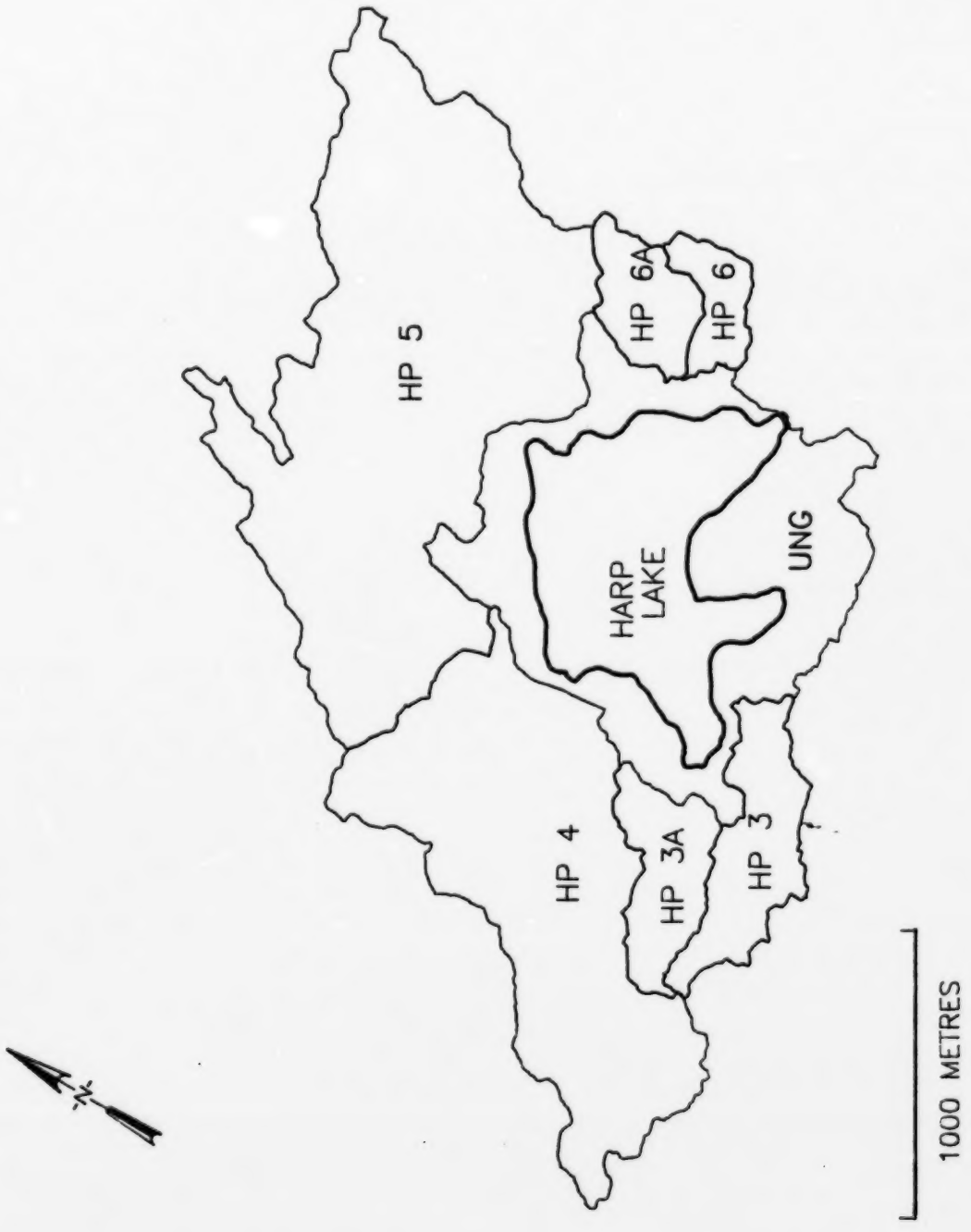


Table 5. Harp Lake catchment

	Area (ha)
Inflows	
#3	26.0
#3A	19.65
#4	119.09
#5	190.53
#6	9.97
#6A	15.28
Ungauged	90.14
TOTAL	470.66
Lake	71.38
Total Catchment	542.04

FIGURE 6: HENEY LAKE

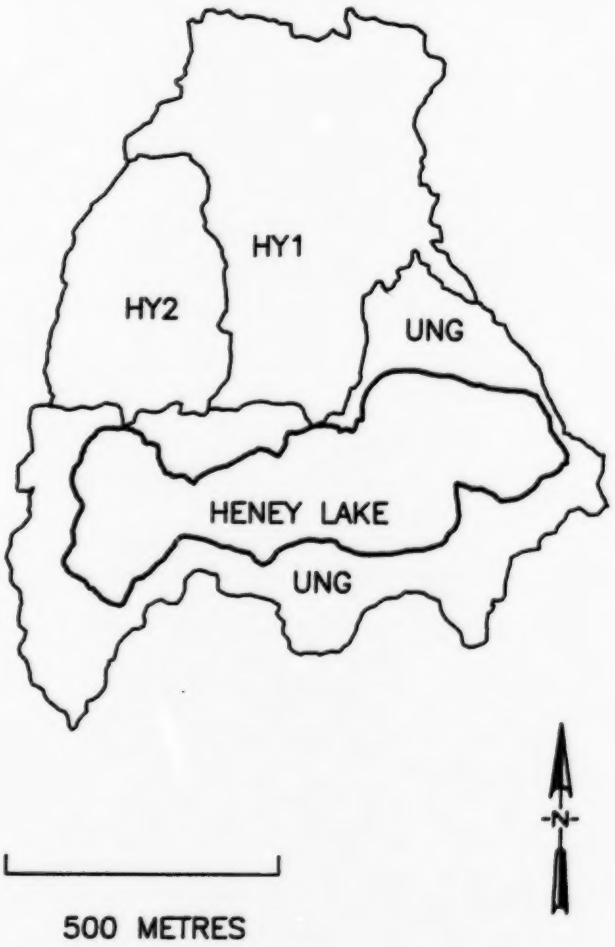


Table 6. Heney Lake catchment

	Area (ha)
Inflows	
#1	29.34
#2	13.69
Ungauged	28.63
TOTAL	71.66
Lake	21.37
Total Catchment	93.03

FIGURE 7: PLASTIC LAKE

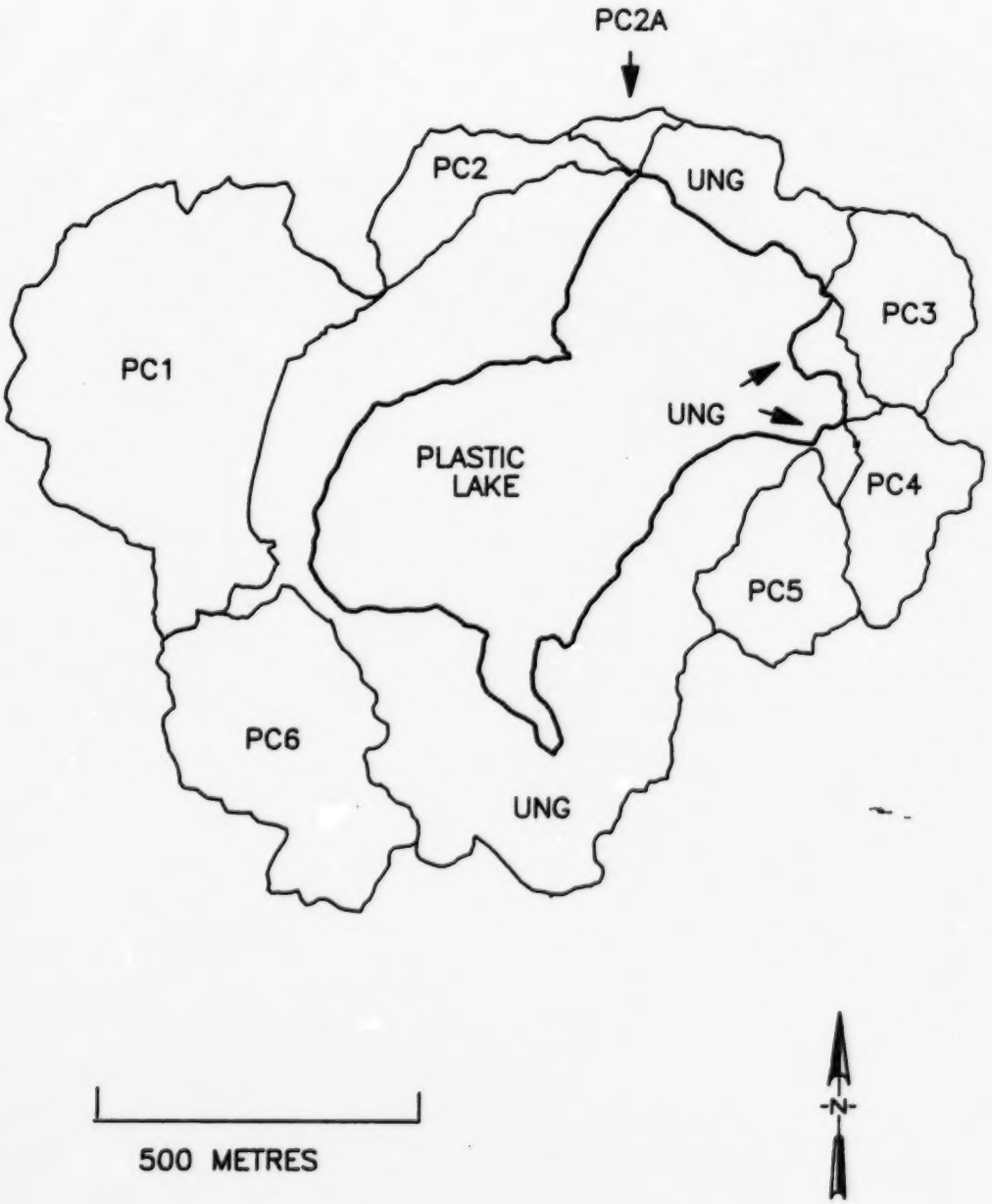


Table 7. Plastic Lake catchment

	Area (ha)
Inflows	
#1	23.34
#2	4.01
#2A	0.99
#3	5.15
#4	4.81
#5	5.18
#6	12.33
Ungauged	36.69
TOTAL	92.50
Lake	32.14
Total Catchment	124.64

FIGURE 8: RED CHALK

Table 8. Red Chalk Lake catchment

	Area (ha)
Inflows	
#1	133.58
#2	26.96
#3	70.49
#4	45.46
Blue Chalk Outflow	158.28
Ungauged	97.59
TOTAL	532.36
Lake	57.13
Total Catchment	589.49

Appendix 2. Micro Catchments

Harp Lake Inflow #4

Paint Lake Inflow #1

Plastic Lake Inflow #1

FIGURE 9: HARP #4 – MICROWATERSHEDS

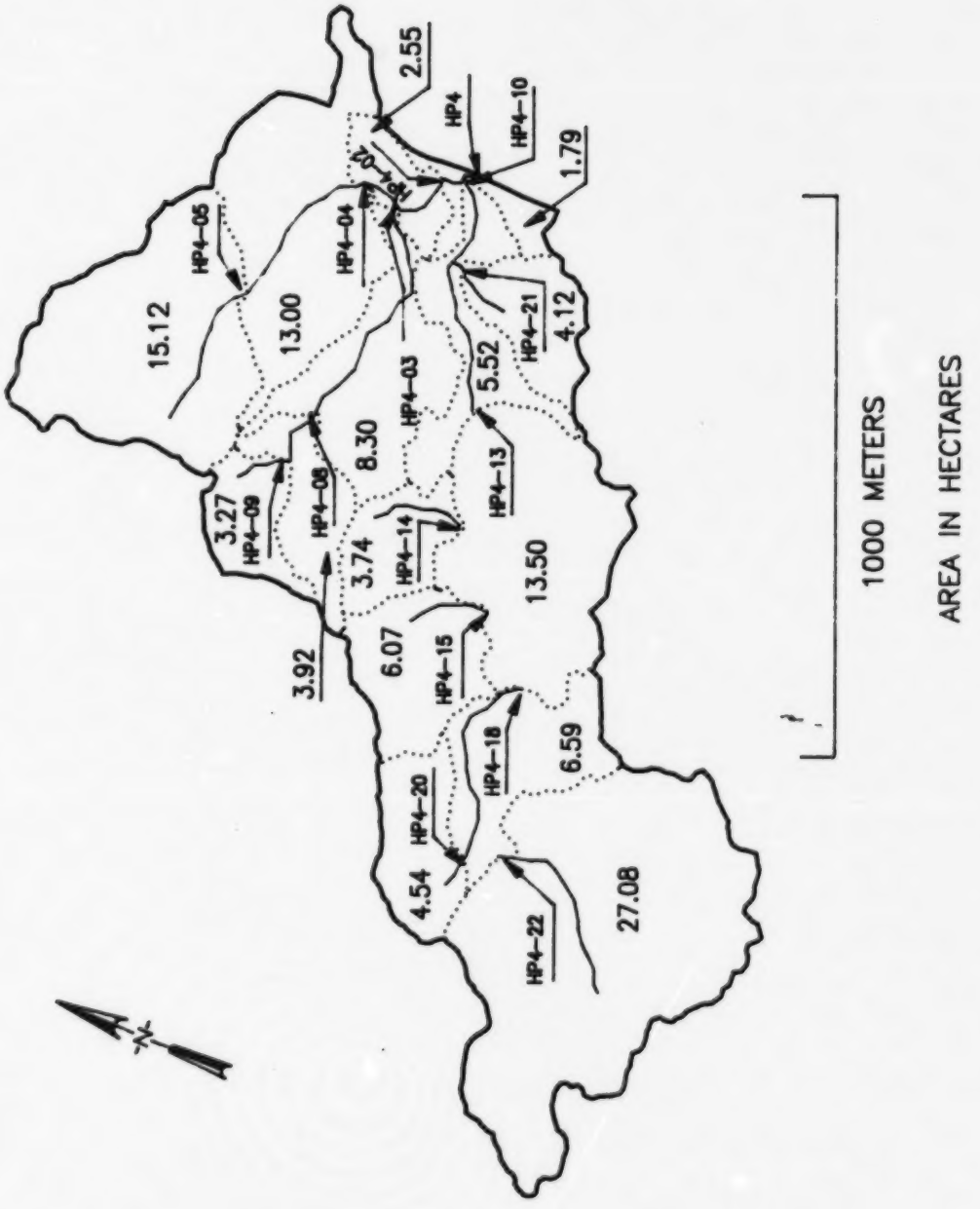


Table 9. Harp Inflow #4 - Micro catchments. Area is the total land area upstream of the sample site.

	Area (ha)
HP 4	119.09
HP4 - 02	46.16
03	15.49
04	28.13
05	15.12
08	7.19
09	3.27
10	71.14
13	61.51
14	3.74
15	6.07
18	38.21
20	4.54
21	4.12
22	27.08

FIGURE 10: PAINT INFLOW #1 – MICROWATERSHEDS

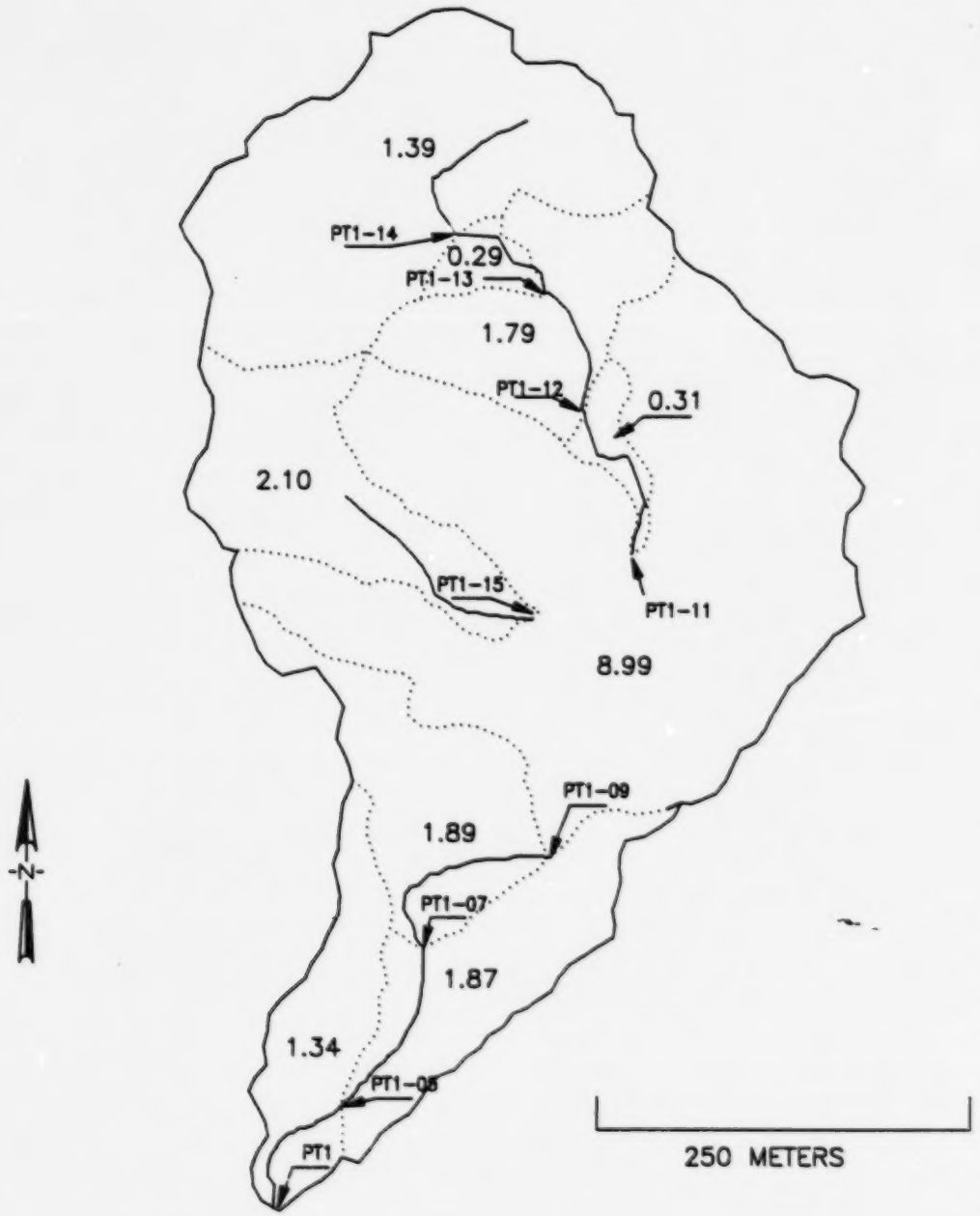
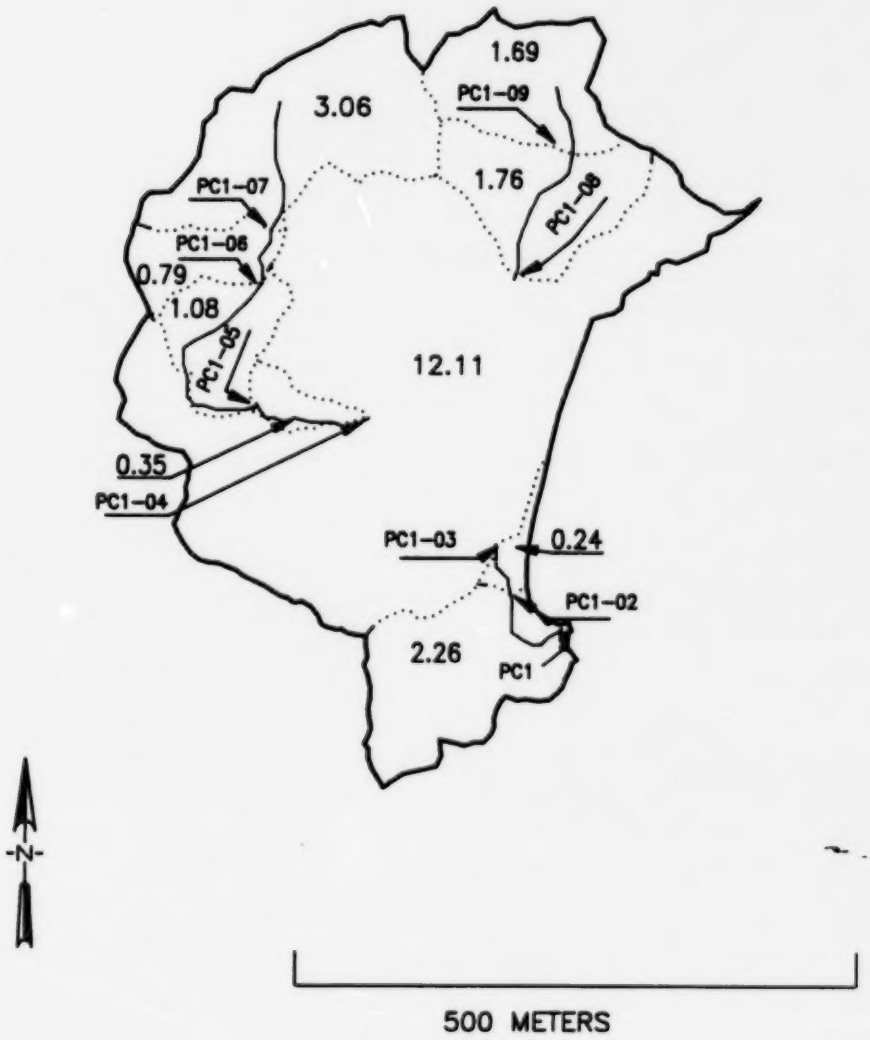


Table 10. Paint Lake #1 - Micro catchments. Area is the total land area upstream of the sample site.

	Area (ha)
PT 1	23.15
PT1 - 05	21.76
PT1 - 07	19.89
09	18.00
11	6.91
12	6.59
13	4.81
14	4.52
15	2.10

FIGURE 11: PLASTIC #1 – MICROWATERSHEDS



AREA IN HECTARES

Table 11. Plastic Inflow #1 - Micro catchments. Area is the total land area draining to the sample site.

	Area (ha)
PC 1	23.35
PC1 - 02	21.08
03	20.84
04	5.28
05	4.93
06	3.86
07	3.06
08	3.45
09	1.69

Appendix 3. Morphometry

Blue Chalk

Chub

Crosson

Dickie

Harp

Heney

Plastic

Red Chalk

FIGURE 12: BLUE CHALK LAKE

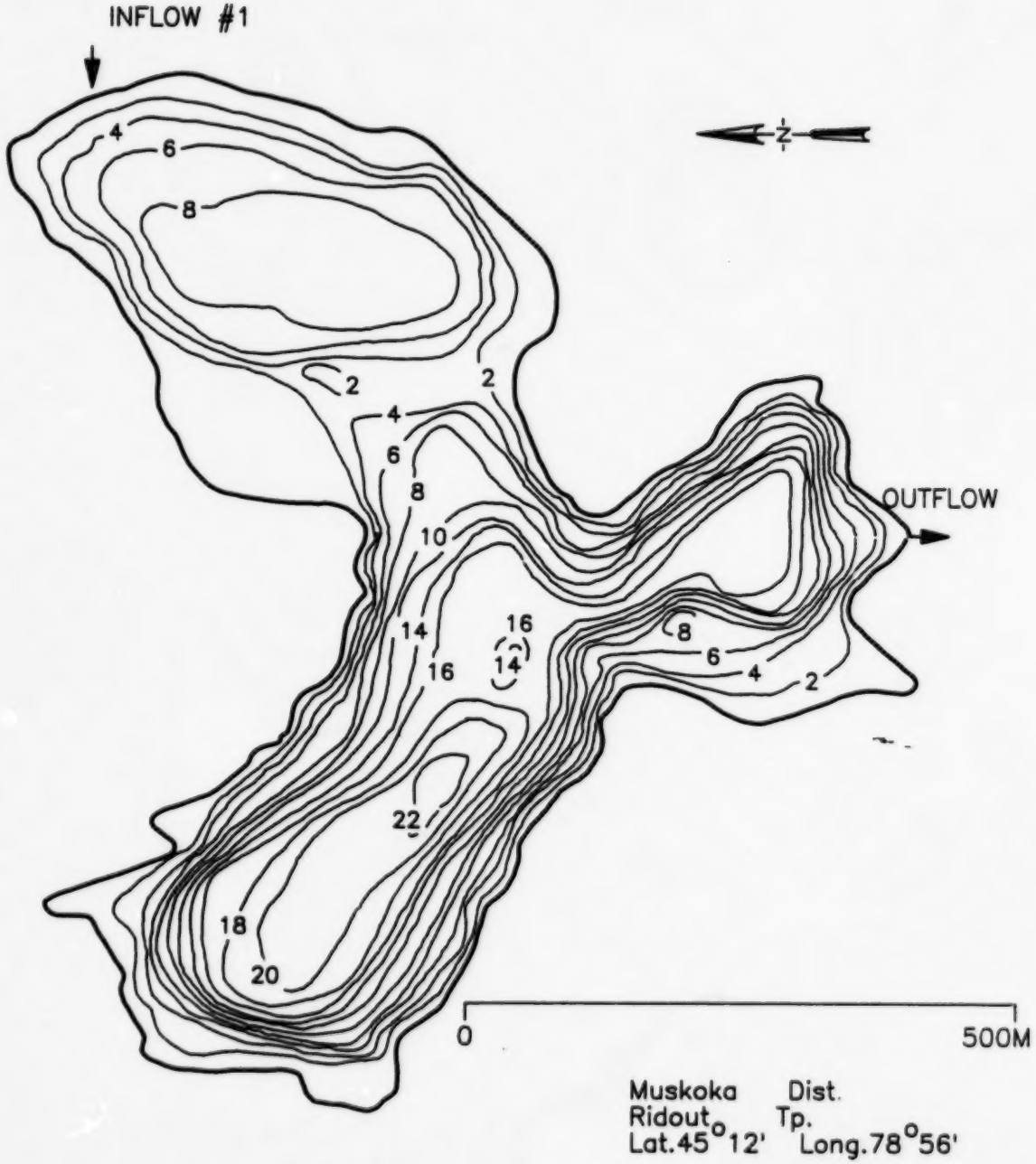
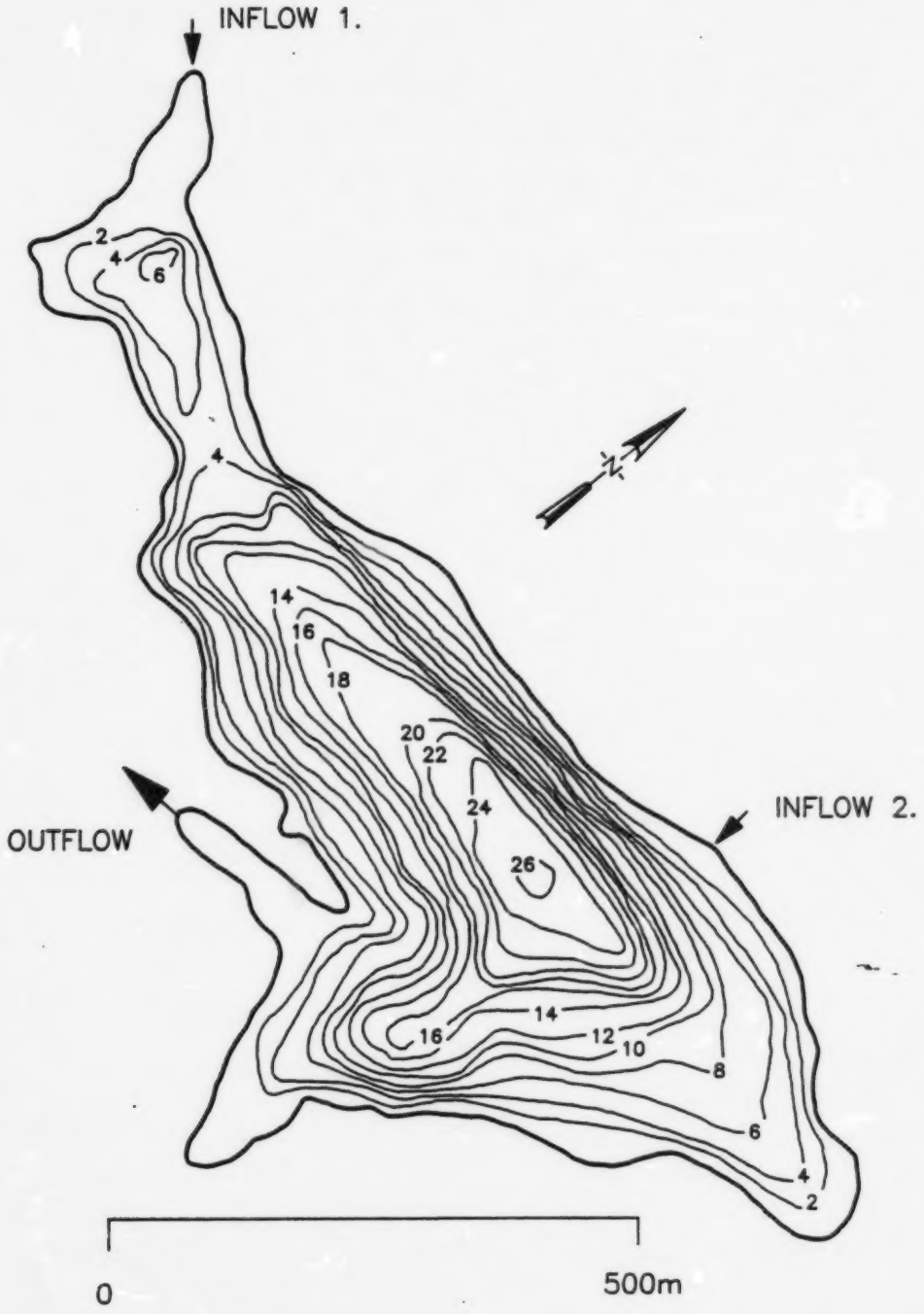


Table 12. Blue Chalk Lake morphometry summary

Lake Area A (ha)	Lake Volume V ($m^3 x 10^5$)	Mean Depth $\bar{z}$ (m)	Maximum Depth Zm (m)	Shoreline Length L (km)	Development of Shoreline D_L	Development of Volume D_V
52.35	44.68	8.5	23	4.67	1.82	1.11

Contour Depth (m)	Contour Area (ha)	Stratum Volume ($m^3 x 10^5$)
0	52.35	
		9.42
2	42.08	
		7.83
4	36.28	
		6.74
6	31.14	
		5.55
8	24.52	
		4.19
10	17.56	
		3.29
12	15.34	
		2.79
14	12.64	
		2.28
16	10.22	
		1.49
18	5.02	
		0.79
20	2.93	
		0.29
22	0.38	
		0.01
23	0.0	

FIGURE 13: CHUB LAKE



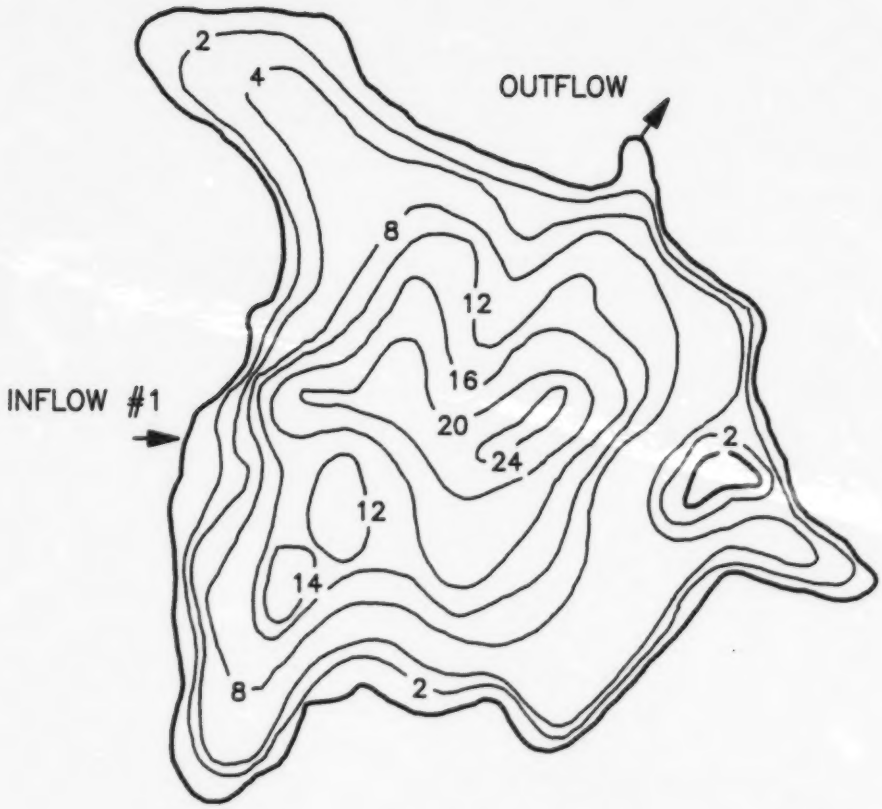
Muskoka Dist.
Ridout Tp.
Lat. 45°13' Long. 78°59'

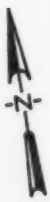
Table 13. Chub Lake morphometry summary

Lake Area A (ha)	Lake Volume V ($m^3 x 10^5$)	Mean Depth $\bar{z}$ (m)	Maximum Depth Zm (m)	Shoreline Length L (km)	Development of Shoreline D_L	Development of Volume D_V
34.41	30.42	8.9	27	4.18	2.01	0.99

Contour Depth (m)	Contour Area (ha)	Stratum Volume ($m^3 x 10^5$)
0	34.41	
		6.17
2	27.39	
		5.06
4	23.22	
		4.19
6	18.71	
		3.39
8	15.25	
		2.81
10	12.88	
		2.37
12	10.89	
		1.91
14	8.25	
		1.46
16	6.40	
		1.13
18	4.93	
		0.84
20	3.47	
		0.60
22	2.52	
		0.38
24	1.34	
		0.12
26	0.12	
		0.004
27	0.0	

FIGURE 14: CROSSON LAKE





0 500m

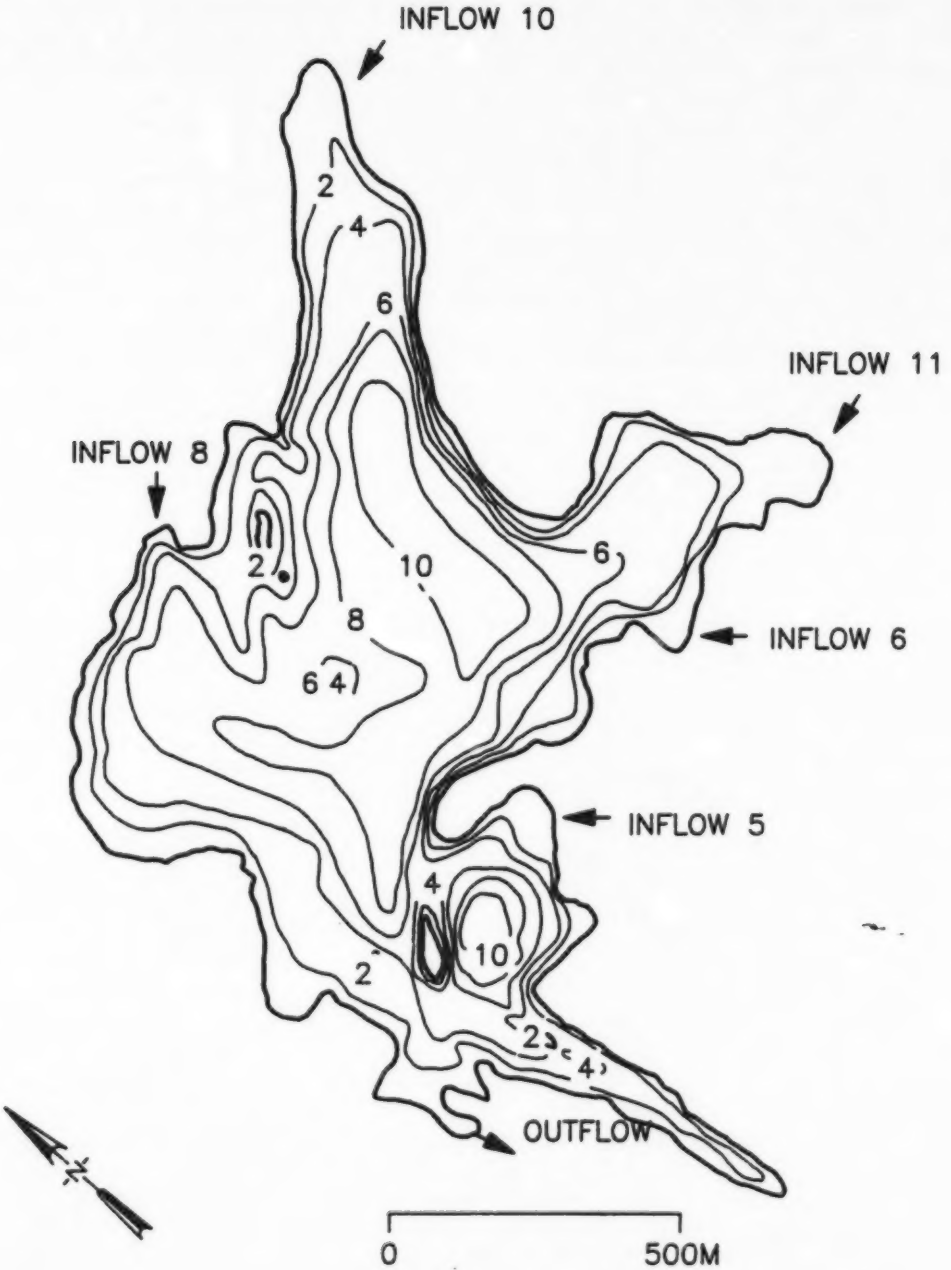
Muskoka Dist.
Oakley Tp.
Lat. 45° 05' Long. 79° 02'

Table 14. Crosson Lake morphometry summary

Lake Area A (ha)	Lake Volume V (m^3X10^5)	Mean Depth $\bar{z}$ (m)	Maximum Depth Zm (m)	Shoreline Length L (km)	Development of Shoreline D_L	Development of Volume D_V
56.74	52.16	9.2	25.0	4.40	1.65	1.10

Contour Depth (m)	Contour Area (ha)	Statum Volume (m^3X10^5)
0	56.74	
		10.70
2	50.28	
		9.30
4	42.80	
		7.74
6	34.75	
		6.14
8	26.83	
		4.89
10	22.13	
		3.98
12	17.77	
		3.14
14	13.75	
		2.36
16	9.92	
		1.73
18	7.48	
		1.26
20	5.15	
		0.67
22	1.83	
		0.23
24	0.58	
		0.02
25	0.00	

FIGURE 15. DICKIE LAKE



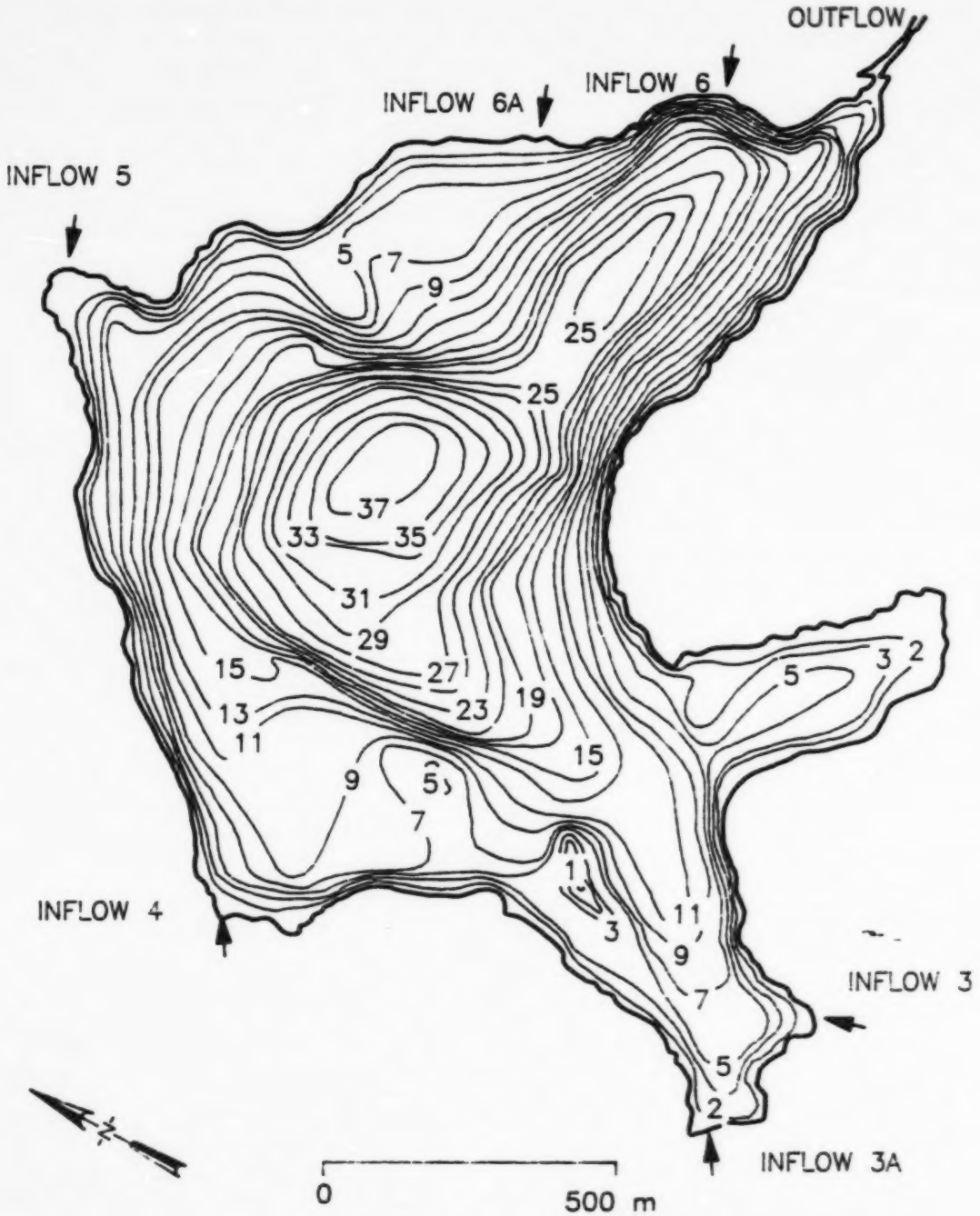
Muskoka Dist.
McLean Tp.
Lat. 45°09' Long. 79°05'

Table 15. Dickie Lake morphometry summary

Lake Area A (ha)	Lake Volume V ($m^3 x 10^5$)	Mean Depth $\bar{z}$ (m)	Maximum Depth Zm (m)	Shoreline Length L (km)	Development of Shoreline D_L	Development of Volume D_V
93.6	46.65	5.0	12	8.22	2.40	1.25

Contour Depth (m)	Contour Area (ha)	Stratum Volume ($m^3 x 10^5$)
0	93.60	
		16.81
2	74.84	
		7.02
3	65.72	
		6.13
4	56.94	
		4.87
5	40.81	
		3.75
6	34.23	
		3.05
7	27.00	
		2.28
8	18.76	
		1.56
9	12.58	
		0.89
10	5.61	
		0.28
11	0.76	
		0.03
12	0.0	

Figure 16: HARP LAKE



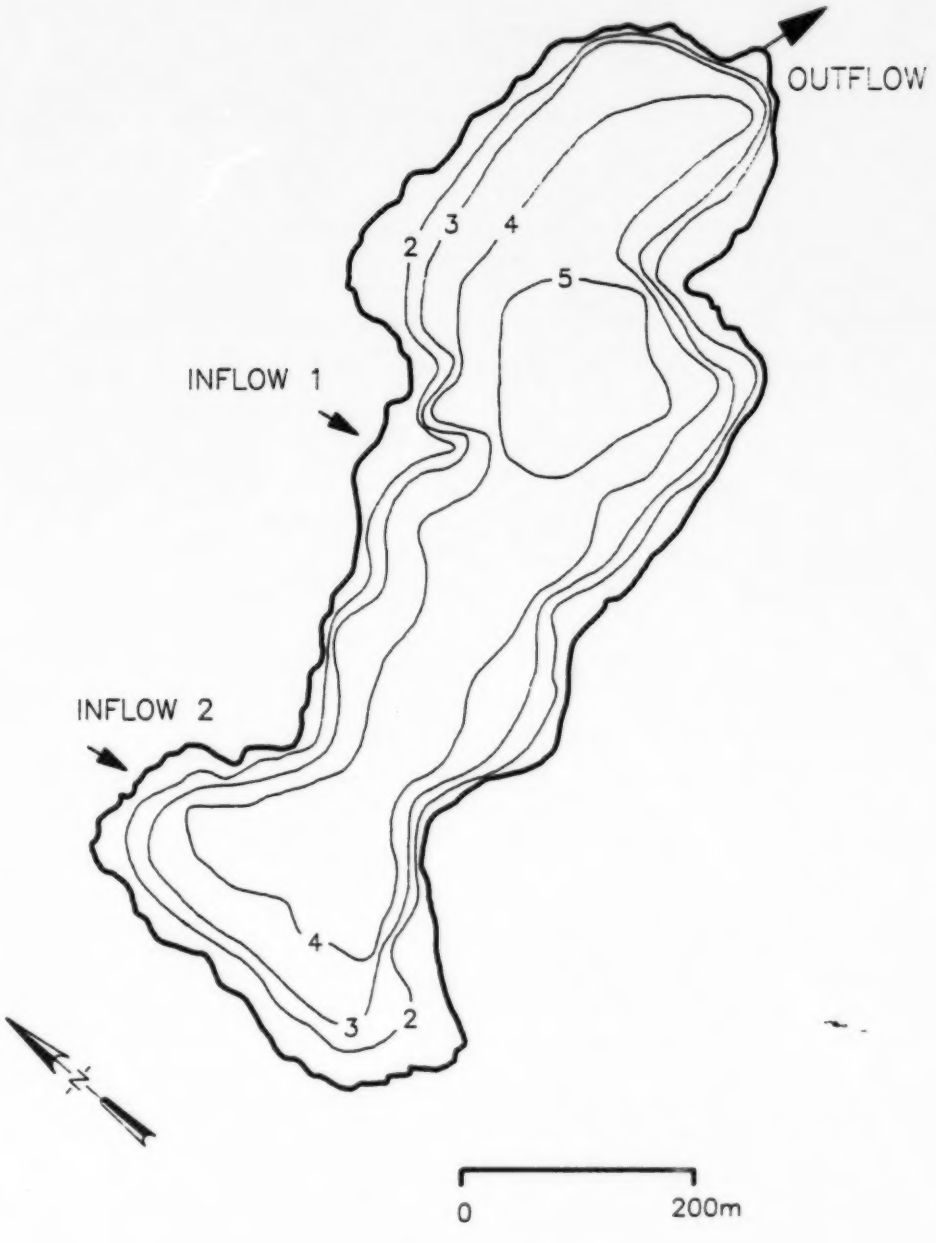
Muskoka Dist.
Chaffey Tp.
Lat. 45°23' Long. 79°07'

Table 16. Harp Lake morphometry summary

Lake Area A (ha)	Lake Volume V ($m^3 x 10^5$)	Mean Depth $\bar{z}$ (m)	Maximum Depth Zm (m)	Shoreline Length L (km)	Development of Shoreline D_L	Development of Volume D_V
71.38	95.07	13.32	37.5	4.75	1.59	0.93

Contour Depth (m)	Contour Area (ha)	Stratum Volume ($m^3 x 10^5$)
0	71.38	
		13.75
2	66.10	
		12.43
4	58.64	
		11.06
6	51.73	
		9.64
8	44.77	
		8.29
10	38.13	
		7.02
12	32.47	
		6.02
14	27.85	
		5.16
16	23.93	
		4.45
18	20.61	
		3.82
20	17.69	
		3.28
22	15.20	
		2.79
24	12.43	
		2.19
26	9.69	
		1.71
28	7.42	
		1.29
30	5.62	
		0.97
32	3.99	
		0.65
34	2.64	
		0.42
36	1.48	
		0.14
37.5	0.00	

FIGURE 17: HENEY LAKE



Muskoka Dist.
McLean Tp.
Lat. 48°08' Long. 79°06'

Table 17. Heney Lake morphometry summary

Lake Area A (ha)	Lake Volume V ($m^3 x 10^5$)	Mean Depth $\bar{z}$ (m)	Maximum Depth Zm (m)	Shoreline Length L (km)	Development of Shoreline D_L	Development of Volume D_V
21.37	7.05	3.29	5.8	2.72	1.66	1.70

Contour Depth (m)	Contour Area (ha)	Stratum Volume ($m^3 x 10^5$)
0	21.37	
		2.02
1	19.04	
		1.79
2	16.84	
		1.55
3	14.23	
		1.14
4	8.79	
		0.53
5	1.81	
		0.05
5.8	0.00	

Figure 18: Plastic Lake

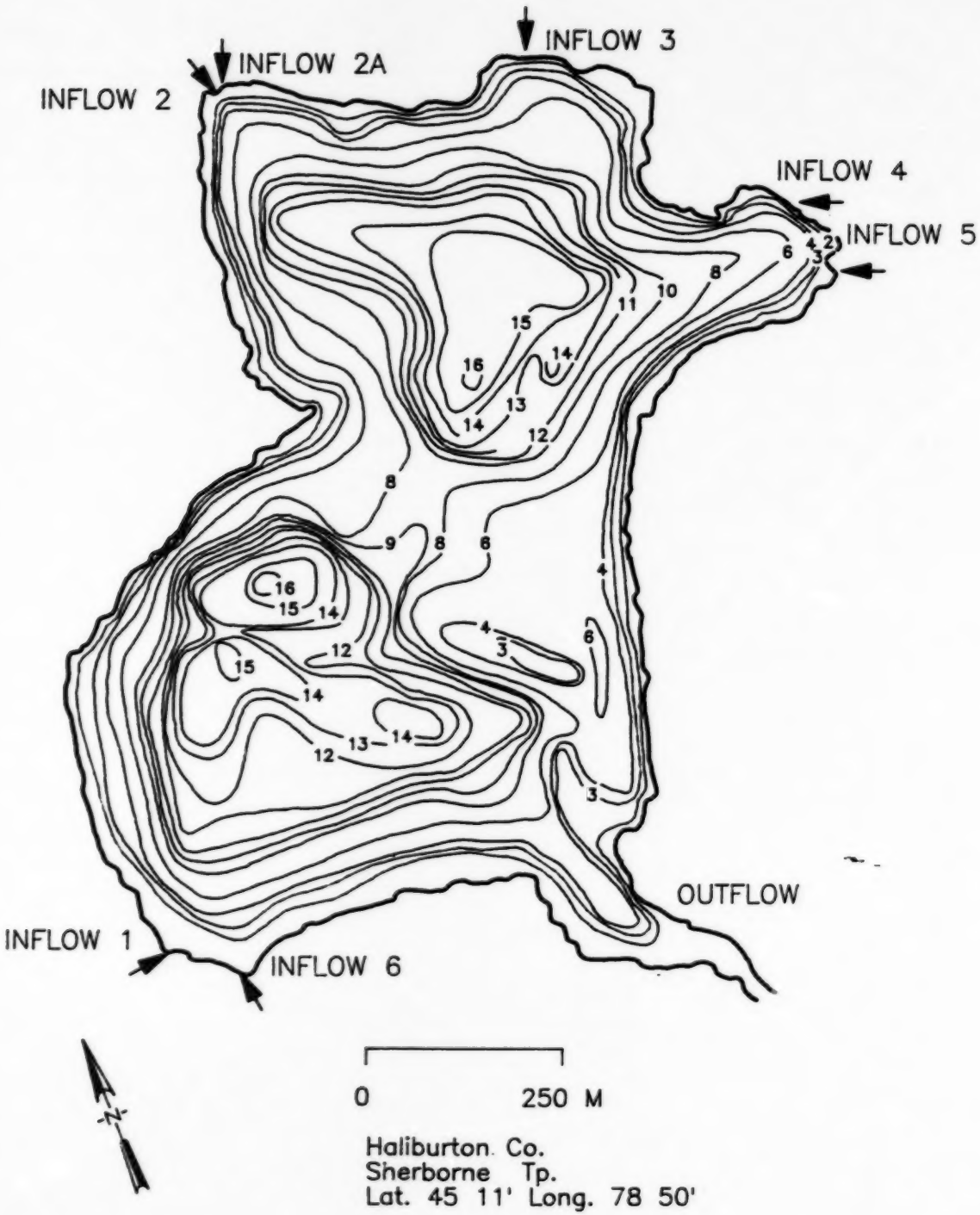
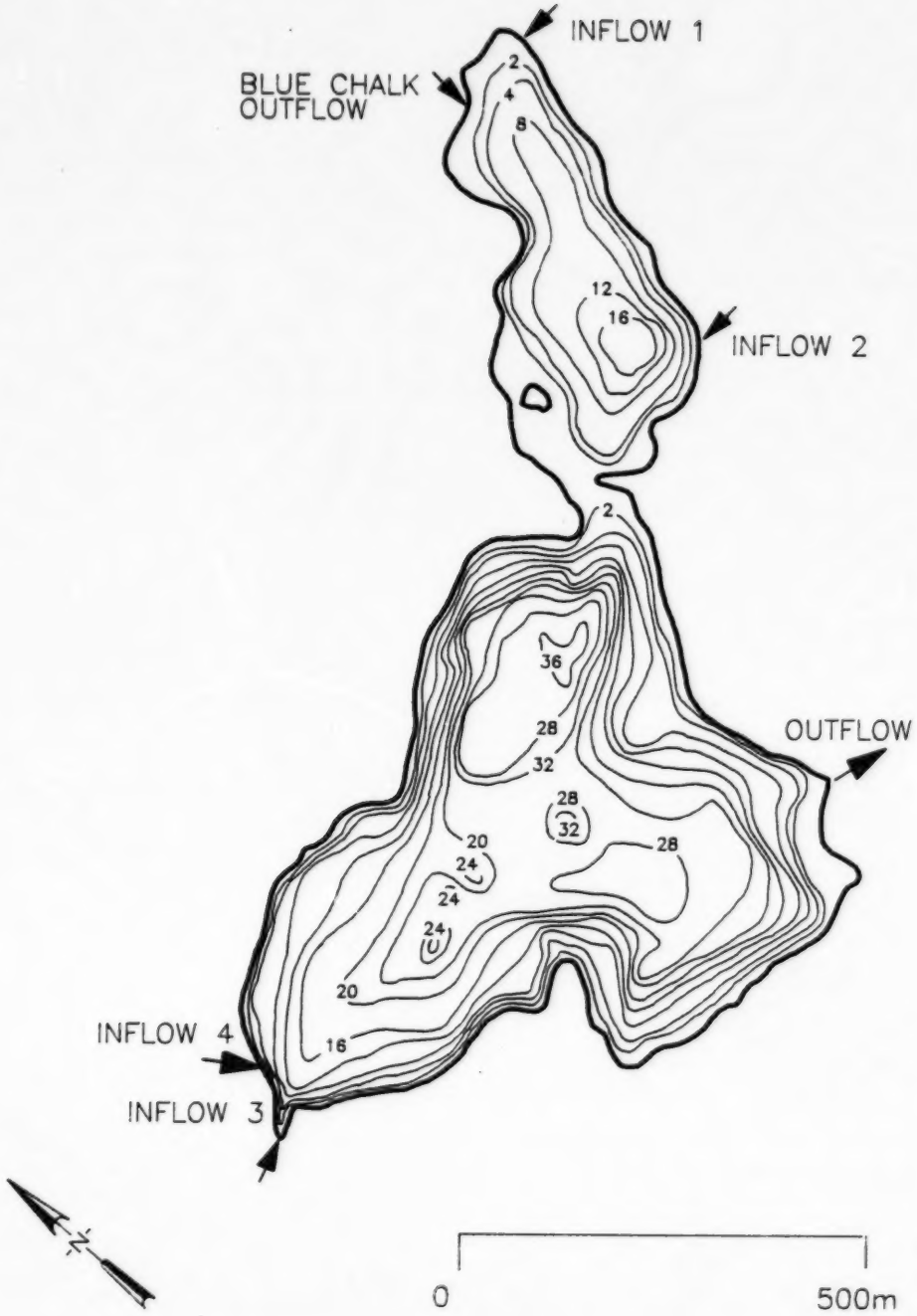


Table 18: Plastic Lake morphometry summary

Lake Area A (ha)	Lake Volume V ($m^3 x 10^5$)	Mean Depth $\bar{z}$ (m)	Maximum Depth Zm (m)	Shoreline Length L (km)	Development of Shoreline D_L	Development of Volume D_V
32.14	25.24	7.9	16.3	3.14	1.56	1.50

Contour Depth (m)	Contour Area (ha)	Stratum Volume ($m^3 x 10^5$)
0	32.14	
		6.11
2	28.97	
		5.37
4	24.84	
		4.47
6	19.65	
		3.46
8	14.95	
		2.60
10	11.23	
		1.88
12	7.29	
		1.06
14	3.35	
		0.297
16.3	0.00	

Figure 19: Red Chalk Lake



Muskoka Dist
Ridout Tp.
Lat 45 11' Long 78 56'

Table 19. Red Chalk Lake morphometry summary

	Lake Area A (ha)	Lake Volume V ($m^3 \times 10^5$)	Mean Depth $\bar{z}$ (m)	Maximum Depth Zm (m)	Shoreline Length L (km)	Development of Shoreline D_L	Development of Volume D_V
Whole Lake	57.13	81.10	14.2	38	4.97	1.85	1.12
Main Basin	44.08	73.52	16.7	38	3.24	1.37	1.32
East Basin	13.05	7.48	5.7	19	1.72	1.34	0.90

Whole Lake			Main Basin			East Basin		
Contour Depth (m)	Contour Area (ha)	Stratum Volume ($m^3 \times 10^5$)	Contour Depth (m)	Contour Area (ha)	Stratum Volume ($m^3 \times 10^5$)	Contour Depth (m)	Contour Area (ha)	Stratum Volume ($m^3 \times 10^5$)
0	57.13		0	44.08		0	13.05	
		10.59			8.4			2.18
2	48.85		2	39.97		2	8.88	
		9.37			7.76			1.61
4	44.87		4	37.60		4	7.27	
		8.56			7.27			1.28
8	36.83		8	32.70		6	5.59	
		6.96			6.29			0.97
12	29.10		12	27.81		8	4.12	
		5.56			5.34			0.66
16	24.05		16	23.54		10	2.50	
		4.52			4.45			0.37
20	18.49		20	18.49		12	1.30	
		3.46			3.46			0.20
24	13.87		24	13.87		14	0.76	
		2.31			2.31			0.13
28	5.77		28	5.77		16	0.51	
		1.00			1.00			0.07
32	3.02		32	3.02		18	0.25	
		0.42			0.42			0.01
36	0.32		36	0.32		19	0.0	
		0.02			0.02			
38	0.00		38	0.00				

Appendix 4. Export stream areas

Table 20. Export Stream Areas (Scheider et al. DR 83/6)

	Area (ha)
Beech Inflow #1 (BE1)	571.6
Paint Inflow #1 (PT1)	23.15
Twelve Mile North (TWN)	426.7
Twelve Mile South (TWS)	171.8